

Notes on Stomatopoda in the Raffles Museum,

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The Stomatopoda are represented in the Raffles Museum by fourteen species, of which eleven belong to the genus *Squilla* and the remaining three to the genera *Lysiosquilla*, *Pseudosquilla* and *Gonodactylus*.

The greater part of the material has been collected during the last two years around Singapore Island and in the local fishmarkets. In addition to this, specimens of a number of species were obtained by exchange from the Indian Museum, Calcutta, in 1921, and small collections were made in the South Natuna Islands in 1929 by Mr. P. M. de Fontaine and in Christmas Island, Indian Ocean, in 1932 by the writer. Also the museum is indebted to Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S. S. and F. M. S., for the gift of a specimen of the rare *Squilla decorata* (Wood-Mason) from Penang.

The richest collecting ground in Singapore is the stretch of shore from Siglap to Telok Kurau on the south coast of the Island.

Here the shore is sandy and shelves very gradually, so that at low spring tides there is a wide area of exposed sand and shallow water. A far greater variety of animals is found in this littoral zone in the south west than in the north east monsoon. This is probably because the more violent wave action that prevails in the north east monsoon drives the littoral fauna to a less disturbed environment in deeper water.

In the fishmarkets Stomatopods are sold for food in relatively small quantities together with prawns and other Crustacea.

In inspecting living and freshly killed individuals it was observed that in the case of the easily confused members of the "*Squilla nepa* group", the colours of the telson and uropods are distinctive and constant in the four species that have been collected, *S. nepa* Latr., *S. oratoria* var. *inornata* Tate, *S. interrupta* Kemp, and *S. wood-masoni* Kemp. These colours have been described rather fully for these species for the benefit of other collectors who have the opportunity of examining fresh material.

In measuring the specimens, the total length is taken as the distance between the tip of the rostrum and the tips of the submedian spines of the telson.

No attempt has been made to give complete synonymies of the species. These will be found in almost all cases in Kemp's monograph on the Stomatopoda of the Indo-Pacific Region, published in the Memoirs of the Indian Museum, IV, 1913.

The writer's acknowledgements and thanks are due to Dr. B. N. Chopra of the Indian Museum, Calcutta, for his kind assistance in working out the material.

Squilla decorata (Wood-Mason).

1875. *Clorida decorata*, Wood-Mason, Proc. As. Soc. Bengal, p. 231, reprinted in Ann. Mag. Nat. Hist. (4), XVII, p. 263 (1876).

1913. *Squilla decorata*, Kemp, Mem. Ind. Mus., IV, p. 27, pl. i, figs. 13-16.

1921. *Squilla decorata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 299.

1934. *Squilla decorata*, Chopra, Rec. Ind. Mus., XXXVI, p. 21.

A single male from Penang, taken from a fish trap in 4-5 fathoms, presented by Mr. W. Birtwistle, Officer-in-Charge, Fisheries Department, S. S. and F. M. S.

This specimen agrees well with the descriptions and figures published by Wood-Mason¹ and Kemp (l.c.), presenting all the features listed by the latter author which distinguish the species from *S. latreillei* (Eyd. and Soud.).

In Kemp's description the lateral margin of the seventh thoracic somite is described as "produced in front as a sharp

¹ Wood-Mason, Figs. and Desc. of nine Squillidae, p. 9, pl. iv, figs. 14-17 (Calcutta, 1895).

spine." In the present specimen it is dentiform rather than spiniform, but definitely not rounded as in *S. latreillei*.

The following carinae end in spines:—

Carinae	Abdominal Somites
Submedian 6
Intermediate 4, 5, 6
Lateral 3, 4, 5, 6
Marginal 3, 4, 5

In this respect, therefore, it agrees with some of the specimens described by Kemp but is definitely at variance with the one recorded by Chopra (l.c.).

The appearance of the upper surface of the telson agrees better with the figure in Wood-Mason's paper of 1895 (l.c. pl. iv, fig. 16) than with Kemp's figure (l.c. pl. i, fig. 15). In the latter figure, which is of a young female, the arrangement of the tubercles in rows is conspicuous, in the former, less so. In the present specimen the tubercles are even more irregularly arranged and all the carinae are much thickened. Variability in this respect is possibly to be correlated with age, as the present specimen appears to be distinctly larger than any of those previously recorded. The thickening of the carinae is probably a secondary sexual characteristic, as the males of the closely related *S. latreillei* (Eyd. and Soud.) have the carinae of the telson thickened and inflated, as noticed by Kemp.

As regards colour the specimen, which was first examined after a few days preservation in formalin, presents no conspicuous features. The ground colour is yellowish white and the sixth thoracic to the fifth abdominal terga are bordered posteriorly with blackish (cf. Wood-Mason, l.c. p. 11), and there are some faint greyish markings on the carapace. The black spot on the eyestalk, just behind the cornea, is distinct. (cf. Kemp, l.c. p. 28).

The total length is 83 mm., the distance between the antero-lateral spines of the carapace, 7.8 mm., and the greatest length and breadth of the telson 14 mm. and 15.7 mm. respectively.

Squilla decorata is previously known from five specimens, all females, and all from various localities in the Bay of Bengal.

Squilla fasciata de Haan.

1844. *Squilla fasciata*, De Haan, in Siebold's Fauna Japonica Crust., Atlas, pl. li, fig. 4.

1913. *Squilla fasciata*, Kemp, Mem. Ind. Mus., IV, p. 34, pl. 1, figs. 21-23.

1921. *Squilla fasciata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 300.

1926. *Squilla fasciata*, Hansen, Stomatopoda of the Siboga Expedition, p. 5.

One adult male from Siglap, Singapore, July, 1934.

This specimen agrees well with Kemp's description. The shallow grooves on each side of the gastric grooves in the anterior part of the carapace are well marked, and their inner margins are raised into low, slightly pigmented ridges, which are possibly rudimentary representations of the intermediate carinae, described by Kemp as entirely absent. There is also a short but well marked ridge running obliquely back onto the carapace from the base of each of the antero-lateral spines.

The disposition of the carinae on the upper surface of the telson is very similar to that shown in Kemp's figure (l.c. pl. 1, fig. 23) except that those which run onto the primary marginal teeth are thickened—a common secondary sexual characteristic of the male in the group of species to which *S. fasciata* belongs. On the ventral side of the telson the inner carinae on each side of the post-anal carina are well marked, but the outer ones are each represented only by two small, elongate tubercles.

When fresh the specimen had a general reddish tinge, but after a few days preservation in spirit this completely disappeared, except for traces on the raptorial claws. The carinae, especially those on the sixth abdominal somite and the telson, are rather bright bluish green. The exopodite and endopodite of the uropods are blackish distally, as noted by Kemp (l.c. p. 35).

The total length of the specimen is 74 mm.

Squilla quinqueidentata Brooks.

1886. *Squilla quinqueidentata*, Brooks, Voy. H. M. S. 'Challenger', XVI, Stomatopoda, p. 26, pl. i, fig. 3, pl. ii, fig. 6.
1913. *Squilla quinqueidentata*, Kemp, Mem. Ind. Mus., IV, pp. 52, 195.

Five females and one male from Siglap, Singapore, June-July, 1934.

These specimens agree closely with Brooks' original description and present also the characteristic features mentioned by Kemp. The two dark patches on the median carina of the telson are well marked, as also are a series of brownish areas occupying the median posterior portions of the sixth—eighth thoracic and the first—fifth abdominal terga. In life the teeth of the telson were rose pink and the denticles yellow. In the larger specimens there are some yellow markings at the distal end of the raptorial propodite. The largest specimen, a female, measures 101 mm. in total length. The corneal index (see Kemp, l.c. p. 9) is 5.5 in the largest specimen and 4.8 in one of the smaller ones, measuring 67.5 mm. in total length.

Squilla scorpio Latr.

1825. *Squilla scorpio*, Latreille, Enc. Méth., X, p. 472.
1913. *Squilla scorpio*, Kemp, Mem. Ind. Mus., IV, p. 42, pl. ii, fig. 30.

A specimen from Singapore, from the Indian Museum, 1921. Ten specimens from Changi and Siglap, Singapore, and from the local fishmarkets.

Squilla scorpio var. *immaculata* Kemp.

1913. *Squilla scorpio* var. *immaculata*, Kemp, Mem. Ind. Mus., IV, p. 45, pl. ii, fig. 31.
1915. *Squilla scorpio* var. *immaculata*, Kemp, Mem. Ind. Mus., V, p. 193.

Two males obtained from a stream in the mangrove swamps near the mouth of the river Jurong, Singapore (Pandan Forest Reserve), October, 1934.

Both the specimens display the distinguishing characteristics described by Kemp, and the larger one differs from equally large males of the typical species in having no thickening of the carinae of the telson, though Kemp states that the secondary sexual differences are as well marked as in the typical form.

This specimen measures 67 mm. in total length.

Squilla nepa Latr.

1825. *Squilla nepa*, Latreille, Enc. Méth., X, p. 471.
1913. *Squilla nepa*, Kemp, Mem. Ind. Mus., IV, p. 60, pl. iv, fig. 49.
1926. *Squilla nepa*, Hansen, Stomatopoda of the Siboga Expedition, p. 10.

A specimen from Singapore, from the Indian Museum, 1921. Numerous specimens from Siglap, Singapore, the Singapore fish-markets and from Pulau Pisang in the south part of the Malacca Strait.

The colours of the telson and uropods are as follows: Telson dull yellow crossed by a greyish-brown band, punctae grey. Teeth dull blue, carinae and denticles rather bright bluish green. Uropods: distal segment of exopodite greenish yellow with an ill defined blackish inner border; proximal segment yellow in the proximal half and dark greenish blue in the distal half. Endopodite yellow, the distal half clouded with dark grey. The proximal part and the larger spine of the bifurcate process yellowish; the smaller spine, and a well defined area at the base of the larger, dark greenish blue.

The species is also characterised by the presence of a dark patch on the second, and on the posterior half of the fifth, abdominal terga.

Squilla oratoria var. *inornata* Tate

1883. *Squilla inornata*, Tate, Tr. Roy. Soc. S. Aust., VI, p. 51, pl. ii, figs. 3a, b, c.
1913. *Squilla oratoria* var. *perpensa*, Kemp, Mem. Ind. Mus., IV, pp. 70, 196, pl. v, figs. 57-59.
1924. *Squilla oratoria* var. *inornata*, Hale, Rec. S. Aust. Mus., II, p. 495.
1926. *Squilla oratoria* var. *perpensa*, Hansen, Stomatopoda of the Siboga Expedition, p. 11.
1934. *Squilla oratoria* var. *inornata*, Chopra, Rec. Ind. Mus., XXXVI, p. 24.

A specimen from Singapore, from the Indian Museum, 1921. Numerous specimens from Siglap, Singapore, the Singapore fishmarkets and Pulau Pisang in the south part of the Malacca Strait.

One of the characters emphasised by Kemp as distinguishing the variety from the typical form is the interruption of the median carina of the carapace at the base of the anterior bifurcation so that it is "wholly absent for a short space." In the majority of the specimens in the present collection this condition obtains, but quite frequently the discontinuity is incomplete, so that the median carina is in uninterrupted continuity with one of the arms of the anterior bifurcation, and in one specimen there is no discontinuity whatever,¹ so that in this respect the specimen agrees with the typical form. Invariably, however, the dorsal carina of the raptorial carpus is quite typical for var. *inornata*, being entire, and the specimens are undoubtedly referable to the variety.

The colours of the telson and uropods are as follows: Telson greenish above, teeth rose pink, carinae green, denticles green with pale tips. Uropods: distal segment of exopodite divided longitudinally into inner blackish and outer greenish halves; proximal segment bluish white, the external spines rose pink. Endopodite whitish with some dark clouding distally. Spines of bifurcate process rose pink. Basal segment whitish with greenish carinae.

Squilla interrupta Kemp.

1911. *Squilla interrupta*, Kemp, Rec. Ind. Mus., VI, p. 98.
1913. *Squilla interrupta*, Kemp, Mem. Ind. Mus., IV, p. 72, pl. v, figs. 60-62.
1926. *Squilla interrupta*, Hansen, Stomatopoda of the Siboga Expedition, p. 11.

A specimen from Singapore, from the Indian Museum, 1921. A specimen collected off Changi, Singapore by N. Smedley in 8-10 fathoms, 31-1-26. Specimens from Siglap, Singapore, June 1934; two specimens from Penang, taken in a fish trap in 4-5 fathoms, presented by Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S. S. and F. M. S., June 1934.

The colours of the telson and uropods are rather distinctive: Telson light brown with a broad, ill defined, yellow posterior border. A conspicuous chesnut brown spot at the base of the

¹. This specimen was examined by Dr. B. N. Chopra, and is mentioned by him in a footnote in his recent paper (Rec. Ind. Mus. XXXVI, 1934, p. 25).

median carina. Carinae dull green, teeth rose pink, denticles green with light tips. Uropods: both segments of exopodite and distal part of basal segment lemon yellow. Endopodite greyish white, tip lemon yellow. Bifurcate process yellowish, spines rose-pink.

Squilla wood-masoni Kemp.

1911. *Squilla wood-masoni*, Kemp, Rec. Ind. Mus., VI, p. 99.
1913. *Squilla wood-masoni*, Kemp, Mem. Ind. Mus., IV, p. 74, pl. v, figs. 63-65.
1926. *Squilla wood-masoni*, Hansen, Stomatopoda of the Siboga Expedition, p. 12.

A specimen from Singapore, from the Indian Museum, 1921. Numerous specimens from Siglap, Singapore, the Singapore fishmarkets and from Pulau Pisang in the south part of the Malacca Strait.

The colours of the telson and uropods are brilliant and most distinctive: Telson greenish brown; median carina, olive green, submedian carinae crimson, other carinae dull orange. Teeth rose pink, denticles bright orange. Uropods: Both segments of exopodite and distal half of endopodite bright blue. Basal segment whitish, bordered distally with orange. Bifurcate process pale blue, the spines rose pink.

Squilla multicarinata White.

1848. *Squilla multicarinata*, White, Proc. Zool. Soc., p. 144, pl. vi, figs. 1, 1a.
1913. *Squilla multicarinata*, Kemp, Mem. Ind. Mus., IV, pp. 86, 196, pl. vi, figs. 73-76.

Eight males and five females from Siglap, Singapore and from the Singapore fishmarkets, 1933 and 1934. The largest specimen, a female, measures 80 mm. in total length.

Squilla lirata, Kemp and Chopra.

1921. *Squilla lirata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 303.
1934. *Squilla lirata*, Chopra, Rec. Ind. Mus., XXXVI, p. 38.

Seven males and nine females from Siglap, Singapore, June 1933, June-July 1934.

In all the specimens the anterior bifurcation of the median carina of the carapace extends from the mid-dorsal pit without any marked interruption. In two, however, the paired carinae forming the bifurcated part are in contact for a short distance in front of the pit before they diverge, giving the impression at first sight, that the actual bifurcation is anterior to the pit.

Examination of the carinae between the submedians of the first two abdominal somites show that there is some variation in their development. In the two original specimens only three

such carinae were found. In two females from the Raffles Museum¹ (which were collected concomitantly with the present series), Chopra found two more incomplete carinae on these somites, lying on each side of the middle one. In the present series all but four of the specimens have these extra carinae very slightly developed, being represented in some cases by little more than elongate tubercles on the posterior margin of the somite. In the remaining four, all large females, they are developed more or less as described by Chopra, but are never complete as in *S. multicarinata*, White. In some cases there are in addition small elongate tubercles on the posterior margins of these two somites, just inside the submedians, but these are never sufficiently developed to form carinae.

The two largest specimens, both females, measure 80.5 mm. in total length.

Squilla raphidea Fabr.

1798. *Squilla raphidea*, Fabricius, Ent. Syst. Suppl., p. 416.
1913. *Squilla raphidea*, Kemp, Mem. Ind. Mus., IV, p. 88, pl. vii, fig. 77.

Numerous specimens from Siglap, Singapore, and from the local fishmarkets, 1933 and 1934.

Pseudosquilla ciliata (Fabr.) ? var.

1787. *Squilla ciliata*, Fabricius, Mantiss. Insect., I, p. 333.
1913. *Pseudosquilla ciliata*, Kemp, Mem. Ind. Mus., IV, p. 96, 196.
1926. *Pseudosquilla ciliata*, Hansen, Stomatopoda of the Siboga Expedition, p. 17.

A single specimen from Pulau Panjang, South Natuna Islands, collected by P. M. de Fontaine, August 1931.

When this specimen was examined in the first place, it was found to differ in certain respects from the typical form as described by Kemp. It was sent to the Indian Museum, Calcutta, where Dr. B. N. Chopra kindly compared it with the material available there. He found that it differed from the typical form in those respects noted by the writer and in certain minor points as well, and expressed the opinion that if further material presenting the same peculiarities came to hand, there would be justification for separating the form as a variety.

The chief differences are:

- (i) The eyes are shorter than in the typical species, their length being distinctly less than the greatest breadth of the rostrum.
- (ii) The median carina of the telson is strongly sinuous in profile.

The specimen measures 87 mm. in total length.

¹ See Chopra, l.c., pp. 38-39.

Lysiosquilla maculata (Fabr.)

1793. *Squilla maculata*, Fabricius, Ent. Syst., II, p. 511.
1913. *Lysiosquilla maculata*, Kemp, Mem. Ind. Mus., IV, p. 111, pl. viii, figs. 80-94.
1926. *Lysiosquilla maculata*, Hansen, Stomatopoda of the Siboga Expedition, p. 18.

A small female from Siglap, Singapore, and two males from Pulau Panjang, South Natuna Islands, collected by P. M. de Fontaine August 1931.

The larger of the two males measures 233 mm. in total length.

Gonodactylus chiragra (Fabr.).

1781. *Squilla chiragra*, Fabricius, Species Insectorum, I, p. 515.
1913. *Gonodactylus chiragra*, Kemp, Mem. Ind. Mus., IV, p. 155.
1926. *Gonodactylus chiragra*, Hansen, Stomatopoda of the Siboga Expedition, p. 24.

Three specimens from Sultan Shoal, near Singapore, two, a male and a female presented by Mr. A. Monteiro, 1930, and a large female collected in December, 1933. A single female from the west coast of Sumatra, collected in 1897. Six immature specimens collected by the writer in Christmas Island, Indian Ocean, August-September, 1932.

Of the varieties separated by various authors, and summarised by Borradaile in 1907¹, three appear to be represented in the collection:—

Var. *incipiens*, Lanchester, 1903 (type). The female from the west coast of Sumatra and five of the immature specimens from Christmas Island belong here. The larger of the two received from Sultan Shoal in 1930, a male, is also referable to this variety. The carinae of the sixth abdominal segment are produced into spines, but with strong constriction; the median carina of the telson carries a rudimentary spine.

Var. *smithi*, Pocock, 1893. The smaller of the two specimens received from Sultan Shoal in 1930, a female, agrees well with this variety. The specimen collected from the same locality in 1933, a large female measuring 93 mm. in total length is intermediate between this variety and var. *incipiens* Lanch. The carinae of the sixth abdominal segment are compressed and produced without constriction into long spines, but the median carina of the telson does not carry a spine.

Var. *anancyrus*, Borradaile, 1900. One of the small specimens from Christmas Island is referred to this variety.

¹ L. A. Borradaile, Stomatopoda from the Western Indian Ocean, Trans. Linnean Soc., Series ii, Vol. XII, 1907-1909, pp. 209-216.